SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions

16. Find the characteristic equation of the following matrix and verify the Cayley – Hamilton theorem.

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & 1 \end{bmatrix}$$

17. (a) Distinguish between dummy and real indices.

    (b) Prove that $A=\left(y^2 - xy - xy\, x^2\right)$ and $B=\left(-xy\, x^2 - y^2\, xy\right)$ are tensors.

18. Explain a solution of second order differential equation with constant coefficients.

19. Solve Legendre differential equation.

20. Obtain the Green's function for one dimensional case using Sturm – Liouville equation.

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APRIL/MAY 2023

GPH11/DPH11 — MATHEMATICAL PHYSICS — I

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions

1. Check whether the following vectors (1,2,-3)(2,5,1) and (-1,1,4) are linearly dependent or independent.

2. What is meant by eigen value?

3. Show that $\sigma_{ij}E_{ijk}=0$.

4. State quotient law of tensors.

5. Find the order and degree of the differential equation $\left(\frac{dy}{dx}\right)^2+\frac{y}{x}\frac{dy}{dx}=a$.

6. What are Singular points of differential equation.

7. List any two recurrence formula for Bessel polynomial.

8. Write the Rodrigue's formula for Hermite polynomial.

9. Give the Fourier transform of delta function.

10. What is the value of the integral $\int_{-\infty}^{+\infty} x\,\delta(x-4)\,dx$?

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions

11. (a) Prove that the trace of a matrix remains invariant under similarity transformation.

Or

(b) Derive Schqwarz inequality from the orthonormal set of vectors.

12. (a) If A^{μ} and B_{μ} are the components of a mixed tensor of rank two.

Or

(b) Show that every tensor of second rank can be resolved into symmetric and anti-symmetric part.

13. (a) Find the power series solution of a differential equation $y''+xy'+(x^2+2)y=0$ in powers of x.

Or

(b) Find the solution of differential equation $y''+4y'+3y=65\cos 2x$.

14. (a) Derive the generating function for Laguerre polynomial.

Or

(b) Prove that

(i) $H_n(-x)=(-1)^n H_n(x)$ and

(ii) $H_{2n}(0)=(-1)^n (2n)!/n!$

15. (a) Discuss the properties of delta function.

Or

(b) Obtain the solution of the three dimensional Helmholtz equation using Green's function.